

Indications and Use of Transesophageal Echocardiography in Intensive Care Patients: Systematic Review

Cobo-Molinos Jesús¹ and Cobo-Molinos Antonio²

¹Neurotraumatológico Hospital Complex of Jaén, Spain

²Departamento of Health Sciences, University of Jaén, Spain

*Corresponding author: Cobo-Molinos Jesús, Neurotraumatológico Hospital Complex of Jaén, Spain, Tel: +34953212121; E-mail: jcobos@ujaen.es

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Abstract

Transesophageal echocardiography is one of the techniques used daily for the study of almost all cardiovascular diseases, being an interesting tool in intensive medicine thanks to the contribution of better images and reaching certain areas of the heart that are inaccessible to conventional echocardiography. In some countries, transesophageal echocardiography is a rare technique, so some doctors are not familiar with it. This paper aims to briefly review the main indications of this study.

Keywords: Transesophageal echocardiography; Doppler; Cardiac imaging; Diagnostic test; Intensive care

Introduction

Transesophageal echocardiography (TEE) helps to a certain extent during the exploration of a patient to obtain a second window for the exploration of the heart, which eliminates the limitations of transthoracic echocardiography may cause during an analysis a critically ill patient. The main uses of this technique are: aortic dissection and other aortic diseases, endocarditis, emboligenic foci and cardiac masses, stenosis and valvular insufficiencies, valvular prostheses, congenital heart disease, critical patient evaluation, intraoperative and interventional echocardiography. Thus transesophageal echocardiography constitutes an excellent complement to the transthoracic [1].

It is a method minimally invasive and easy to insert because it uses natural openings of the body. This allows immediate visualization of the cardiac cavities, their valves and their large vessels. Using pulsed and continuous color Doppler, we quantify velocities and gradients that allow the estimation of volumes and pressures [2].

Adequate intraoperative surveillance allows early changes in the management of patients admitted to the intensive care unit. The detection of alterations of arterial pressure, cardiac rhythm, ventilation and myocardial ischemia with important in these patients so that the imaging techniques are very important. The use of echocardiography has allowed to reduce the incidence of perioperative events in these patients. Three categories are now recognized for perioperative use (Table 1).

Main Indications for the Use of TEE in the Perioperative		
Class I	Class II	Class III
Acute hemodynamic instability of uncertain cause	Risk of myocardial ischemia/Infarction/Hemodynamic alterations	Placement of catheters (IAB, PAC)
ValverRepair	Valve Change/Maze Surgery	Repair of other cardiomyopathies
Congenital heart disease requiring CPB surgeries	Cardiac aneurysms and tumors/Thrombus/foreign body	Surgical repair of ostium secundum, uncomplicated
Repair of hypertrophic cardiomyopathy Endocarditis Surgery	Air embolism detection / myocardial perfusion evaluation Evaluation of atheromatous plaques in the aorta	Monitoring of embolisms in orthopedic surgeries
Aneurysms and aortic dissection with suspicion of Ross' IA	Pulmonary embolism Aneurysms and aortic dissections without suspicion of IA	
Evaluation for procedures in the pericardium (pericardial window)	Cardiac Trauma	

Table 1: Recommendation of the use of TEE according to the type of patient. Class I critical patient, class II preoperative and class III postoperative.

Use in critical care patients

The prior step to the use of this technique is the consent report by the patient or a family member, previously signed. Depending on the hospital and the ethics committee, this report is the prelude to performing the technique.

TEE is a semi-invasive procedure with well-defined criteria for training of personnel [15]. There are three groups of patients to consider when discussing management of sedation for an individual requiring TEE [4]. Among the possible complications that the family member or patient should consider are those related to drugs for sedation and those derived from the introduction of the catheter (trauma to the teeth, gums, oropharynx or esophagus).

The use of this technique can be performed in any patient admitted to intensive care taking into account that a patient with an acute aortic syndrome should be considered in the differential diagnosis all variants of acute aortic disease. In addition to classical aortic dissection, this syndrome encompasses intramural hematoma and aortic penetrating ulcer [3,4].

Most common TEE indications in intensive care

Recently, the use of intraoperative TEE should be used in all adult patients for emergency cardiac surgery such as valvular procedures and procedures in the thoracic aorta among others. In addition, we must consider its clinical application in myocardial revascularization surgeries, with the aim of confirming and refining the preoperative diagnosis, detecting new pathologies, anesthetic and surgical orientation, and evaluating the surgical outcome [5].

We will now describe the most common use of TEE in the intensive care unit.

Aortic dissection and other aortic diseases

TEE has a comparable level of accuracy with computed tomography and magnetic resonance imaging in the diagnosis of aortic dissections. The anatomical proximity of the descending aorta to the esophagus throughout its thoracic path makes this imaging technique ideal for study. With it can be identified among others the dissection flaps and the tears of entry and exit. It may also be used to assess the cause of aortic insufficiency associated with dissection, pericardial effusion, and left ventricular function status [6,7].

TEE seems ideal for the evolutionary control of patients with aortic dissection, given their relatively non-invasive character and their ability to assess the size, thrombus formation and flow patterns of false lumen [8].

Endocarditis

TEE has a higher percentage of vegetation visualization than conventional echocardiography. The use of this tool allows the visualization of smaller vegetations, as well as the possibility of exploring areas that are not well observed with other imaging techniques such as transthoracic echocardiography, thanks to the higher resolution of this technique. The transesophageal study has a high sensitivity in the diagnosis of complications of endocarditis, ruptures of veins, cord tears, formation of abscesses and quantification of the degree of valvular insufficiency [9].

Cardiac emboligenic foci

The study of cardiac emboligenic foci is the pathological indication widely used in intensive medicine. Anomalies related to the most common embolism are thrombi in the atria, atrial and ventricles, tumors, vegetations and protuberant aortic remains, in addition to other probable embolic phenomena such as: oval foramen permeability, spontaneous echocardiographic contrast and aneurysm of the interatrial septum [10].

Valvular insufficiency and stenosis

The proximity of the left atrium to the position of the transesophageal probe and the absence of acoustic impedance allows an unclear view of the mitral insufficiency jet, which makes the TEE an essential tool to assess this pathology. In addition, this technique allows an easy way to collect the flow pattern of the pulmonary veins, thus favoring the assessment of the severity of mitral insufficiency [11]. Another widespread use in intensive medicine is the assessment of the causes of valvular lesions such as vegetations, floating valves, mitral valve prolapse, tendinous cord tears or papillary muscle rupture with this technique [12].

Mitral and aortic insufficiency

In the case of aortic insufficiency as in mitral insufficiency, TEE is indicated when there are doubts about the severity of the lesion and its possible causes. The TEE is no more sensitive than transthoracic echocardiography in the diagnosis of right-sided insufficiencies. The TEE is accurate in the diagnosis and evaluation of valvular stenosis and its severity [13].

Valvular prostheses

The transesophageal study is indicated in four situations: suspicion of mitral prosthetic valve insufficiency (especially if it is a mechanical prosthesis), suspicion of endocarditis, technically difficult transthoracic study, and thromboembolic episode [14,15].

Congenital Heart Disease

TEE is possibly the most accurate technique for the diagnosis of congenital heart disease in patients entering intensive care. It is useful in the diagnosis of atrial septal defects, especially those of the sinus type, where the transthoracic study has a low sensitivity. It also provides more anatomical information in cases of: interventricular communication, abnormal drainage of pulmonary veins, aortic coarctation, Ebstein anomalies, subaortic membrane, bicuspid aorta and patent ductus arteriosus [16,17]. It would also be indicated in any congenital heart disease where the transthoracic study was technically deficient.

Critical patient

In these cases transthoracic echocardiographic examination is often limited by the presence of wounds or tubes that obstruct the access of the transducer, in addition the impossibility of placing the patient in the left lateral decubitus makes that in many scans a quality image is not obtained. The TEE eliminates these disadvantages and obtains images of excellent quality. Its main indications in these patients are: assessment of ventricular function (especially in patients with unexplained hypotension), valvulopathies, suspicion of aortic

dissection or rupture of the aorta, localization of an embolic cardiac focus, mechanical complications of myocardial infarction, Right ventricle, postoperative complications of cardiovascular surgery and diagnosis of infective endocarditis in the intensive care unit [17].

Intraoperative TEE and Surgical Intervention

In adults there are two situations in which intraoperative TEE has been used and are: monitoring of ventricular function in the non-cardiac surgical patient and in the postoperative assessment of valvular repairs [18].

This tool has a great value in the closure of interatrial and interventricular communications using devices based on percutaneous catheters, both before and during and after the intervention. Evaluation of ischemia on ventricular function and direct visualization during endomyocardial biopsy has been two applications of TEE intervention. Some centers use this technique in assessing the valve before and after mitral valve replacement [19].

Doppler

In some cases, lungs, ribs, or body tissues may prevent sound waves and echoes from providing a clear picture of cardiac activity. If this is a problem, the ultrasound assistant may inject a small amount of fluid (contrast material) through an intravenous line to better see the inside of the heart. Doppler echocardiography records the movement of blood through the heart [6].

Conclusions

The intraoperative TEE is a safe and useful method of cardiovascular monitoring in the formulation of the preoperative surgical plan in intensive medicine, in the orientation of hemodynamic interventions and in the immediate evaluation of the operative result for critical patients.

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